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Acute Stress Ulcer after Cardiac Surgery

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Abstract

Forty-four cases (1.3%) of stress ulcer after cardiac surgery were surveyed. Twenty-four of the patients died, and only two could undergo surgery. Perhaps because the majority of cardiac surgery cases were children, 40 of the patients with stress ulcer and 21 of those who died were also children. Major stress factors were renal, pulmonary and cardiac insufficiencies. Onset of ulceration and death occurred, respectively, within 5 and 10 days of operation in most cases. Particularly impressive was the fact that most of the patients were anesthetized for at least 7 hours, suggesting that surgery of this duration provokes stress. Mortality was high, about 50%, irrespective of whether treatment was conservative or surgical.

In rats, the continuous infusion of GIP, somatostatin or neurotensin has proved remarkably effective in the conservative treatment of stress ulcers, and the clinical applicability of this treatment is now being examined.

Key words : Stress ulcer, Cardiac surgery, Curling's ulcer, Cushing's ulcer.
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Introduction

Acute stress ulcer is one of the most troublesome conditions faced by the surgeon, not least because its essential nature remains largely unclear. The poor general condition of patients often precludes surgical intervention, and in operated cases mortality frequently exceeds 50%. Acute stress ulceration is known to be provoked by burns (CURLIG'S ulcer)[1], cerebral damage (CUSHING'S ulcer)[2], bone fractures, injury and other factors, one of which is cardiac surgery.

In 1972 TAYLOR and associates[11] reported the development of acute stress ulceration in 38 of over 5,000 patients who had received cardiac surgery, but in Japan no such reports have appeared. The following is a survey of acute stress ulceration after cardiac surgery performed from 1953 to 1975 at the 2nd Department of Surgery, Faculty of medicine, kyoto university and at related hospitals.

Clinical material

From 1953 through 1975 at the 2nd Department of Surgery, Faculty of medicine, Kyoto University and over the last few years at related hospitals, cardiac surgery has been performed in 3,420 cases. Children under 15 years of age accounted for 2,407 cases (male, 1217 ; female, 1190) and adults 1,013 cases (male, 510; female, 503). Their ages ranged from 6 months to 48 years (Table 1).

Table 1. Age and sex distribution

	male	female	total
children	1217	1190	2407
adult	510	503	1013
	1727	1693	3420

Results

1) *Onset of stress ulcer and age* (Table 2)

Of the 3,420 patients who underwent cardiac surgery, 44 (1.3%) subsequently developed

Table 2. Incidence of stress ulcer according to age group

( ) dead

	male	female	total
children	28 (12)	12 (9)	40 (21)
adult	3 (2)	1 (1)	4 (3)
total	31 (14)	13 (10)	44 (24)

stress ulcers, and 24 of them (54.5%) died. Of these 44 patients, the majority, 40 cases (90.9%), were children, 21 of whom (87.5%) died.

2) *Location of stress ulcers* (Table 3)

The location of stress ulcers was confirmed at laparotomy in 2 cases and at autopsy in 3 cases. The majority occurred in the stomach (ercsion, 1 case ; multiple ulceration, 1 case), duodenum (ulceration, 1 case ; perforation, 1 case) and esophagus (erosion, 1 case); in the remaining case petechiae were seen in all organs. In the other patients, hematemesis and or melena suggested that the ulceration was located in the upper intestinal tract in 34 cases, and in the stomach in 3 cases. No inference could be drawn in 2 cases.

Table 3. Location of stress ulcers

(1).	At laparotomy (2 cases) and autopsy (3 cases)	
	stomach	2 (erosion, multiple ulceration)
	duodenum	2 (ulceration, perforation)
	esophagus	1 (erosion)
	all organs	1 (petechiae)
(2).	Suggestion from hematemesis and melena	
	upper intestinal tract	34
	stomach	3
	unclear	2

3) *Time of onset of ulceration after surgery* (Table 4)

Hematemesis and or melena appeared within 5 days of surgery in the majority of patients (36/44), and most of the deaths (14/24) occurred within 10 days of surgery.

Table 4. Time of onset of ulceration after surgery

days after surgery	onset of hematemesis and or melena	dead
0—5	36	6
6—10	7	8
11—15	0	1
16—20	0	4
21—25	1	1
26—30	0	0
31—35	0	2
36—40	0	1
41—79	0	1
total	44	24

4) *Duration of anesthesia, stress ulcers and mortality* (Table 5)

About half of the patients with stress ulcers (26/44) and one third of those who died (8/24) were anesthetized for 400 to 500 minutes.

5) *Stress ulcers and hypothermic anesthesia* (Table 6)

Hypothermic anesthesia (temperature 14.0—33.5°C) was employed in 38.6% (17/44) of cases.

Table 5. Duration of anesthesia, in relation to stress ulcers and mortality

minutes	stress ulcers	deaths
300—399	7	5
400—499	26	8
500—599	7	7
600—699	3	3
700—799	0	0
800—899	0	0
900—999	1	1
total	44	24

Table 6. Stress ulcers and hypothermic anesthesia (temperature 14.0-33.5°C)

employed		not employed		total
adult	children	adult	children	
2(2)	15(13)	2(1)	25(8)	44(24)

( ) dead

6) *Stress factors* (Table 7)

The major stress factors were renal insufficiency, pulmonary insufficiency, and cardiac insufficiency ; other factors included disturbance of consciousness, hemiplegia, pulmonary edema, leakage of prosthetic valves, and septicemia.

Table 7. Stress factors

factors	cases
renal insufficiency	12
pulmonary insufficiency	5
cardiac insufficiency	3
disturbance of consciousness	2
hemiplegia	1
pulmonary edema	1
leakage of prosthetic valves	1
septicemia	1
none	21

7) *Mortality after treatment*

Stress ulcers were treated conservatively in 42 of the 44 patients ; surgical treatment (total gastrectomy) was possible in only 2 patients. Conservative treatments included blood transfusion, cold-saline gastric lavage, and the administration of antacids; surgical treatment was total gastrectomy. The mortality was 54.5% (24/44) overall, 54.8% (23/42) in the conservatively treated patients, and 50.0% (1/2) in the surgically treated patients.

Discussion

The incidence of CURLING's ulcer[1] following burns has been reported to be 11.7% by

PRUITT[9] and 37% by HUSAMOTO[3] ; that of CUSHING's ulcer[2] accompanying central nervous system disturbances to be 54% by SPENCER[10], 17% by HUSAMOTO[4], and 74% by KAWANO[5]; and that of stress ulcer after bone fracture to be 2.1% by MEARS[7], and 9.6% by HUSAMOTO[3]. In contrast, TAYLOR[11] found stress ulceration after cardiac surgery in only 0.76% of cases, while in Japan this complication has not been reported.

In this survey, the incidence of stress ulcer after cardiac surgery was 1.3%, lower than that of CURLING's ulcer, CUSHING's ulcer or stress ulcer following bone fracture. However, the general condition of the patients with stress ulcer after cardiac surgery was poor, and surgical treatment was impossible in most cases. The majority of cardiac cases were children, as were the majority of patiensts with stress ulcer (40/44) and of the patients who died (21/24). By inference from the occurrence of hematemesis and melena, and by observation at surgery or autopsy, the stress ulcers were thought to be located mostly in the upper digestive tract. When hematemesis and or melena occurred, the onset was within 5 days of cardiac surgery in most cases ; and when death occurred it was within 10 days of the surgery in most cases. The duration of anesthesia for cardiac surgery was from 300 to 1,000 minutes ; but about half of the patients who developed stress ulcers, and one third of those who died, were under anesthesia from 400 to 500 minutes. An operative procedure longer than 7-8 hours thus appears to place great stress on the body.

The major stress factors were renal, pulmonary and cardiac insufficiencies; hypothermic anesthesia was not considered particularly stress-provoking.

TAYLOR[11] reported an overall mortality of 23.6%, 8.3% after conservative treatment and 30.7% after surgical treatment. The corresponding figures for the series surveyed here were 54.5%, 54.8%, and 50.0%, all higher, and showing no great difference between conservative and surgical treatment. Operative mortality for CURLING's ulcer has been reported to be 58% by O'NEIL[8] and 64% by PRUITT[9], and for CUSHING's ulcer, to be 47% by LUCAS[6].

In rats subjected to restraint and submersion in water to provoke stress ulceration, we[12] found that where gastric ulcers had formed, the gastric endocrine and exocrine cells both showed hyperfunction. We also noted that the development of stress ulcers could be inhibited in over 90%, of the animals by surgical vagotomy, in 100% by medical vagotomy (atropine-hexamethonium bromide), in over 60% by continuous infusion of GIP (gastric inhibitory polypeptide), in over 90% by somatostatin (growth hormone release inhibiting factor), and in 100% by neurotensin (new hypotensive hypothalamic peptide). We are now investigating the clinical applicability of preoperative conservative treatment in the prevention of stress ulceration.

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和文抄録

開心術後のストレス潰瘍

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過去22年間の京大第2外科及び関連4病院での開心術後のストレス潰瘍について検索した．発生頻度は3420例中44例（1.3%）である．開心術症例の大半を小児（2407例）が占めることもあるが，44例のストレス潰瘍中，小児は40例，成人は4例で，死亡例24例中大半の21例が小児である．発生部位は大半が胃，十二指腸，食道の上部消化管で，吐血，下血等の症状発生は多くが術後5日以内である．特に印象的であったのは，ストレス潰瘍の大半及び死亡例の多くが麻酔時間400～500分以内のものにみられ，生体にとって7～8時間の手術は大きなストレスとなることが示唆された．ストレス因子としては大半が腎，肺，心不全である．死亡率は約50%で，内科的，外科的療法を問わず高いものであった．